vol. III no. 1
September, 1943

School Shop

FOR INDUSTRIAL ARTS & VOCATIONAL EDUCATION TEACHERS

PIT Helps Signal Corps Trainees
by Captain W. W. Waite

Coordinated Shop Program for Model Building
by E. E. Miller

Student Personnel Organization
by Edward Stein

Taper Turning
by David T. Armstrong

Shop Tested Projects ● News from Industry ● from Washington! ● Strictly Personal ● News

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The Cover . . . . .

No longer is it a man's world. Ardis Yageman on the cover of this month's SCHOOL SHOP is an emergency substitute teacher of industrial arts in the Detroit, Michigan, public schools who has been receiving intensive training under a directing teacher from Wayne University. She is not a regularly qualified industrial arts teacher but with many others she has been taking an intensive training course in which she has been carrying through the process of making various projects and, in turn, teaching a demonstration lesson on each. At the same time, she has been receiving instruction in the sharpening of tools, care of tools, handling of supplies, preparation of lesson plans, and scheduling of shops. She can return for supplemental training at any time. Many trainees are planning to complete their major in industrial arts and become permanently qualified. The illustration is courtesy of the Detroit Public Schools of which Earl Bedell is Director of Vocational Education.

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School Shop

FOR INDUSTRIAL ARTS & VOCATIONAL EDUCATION TEACHERS

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PIT Helps Signal Corps Trainees

BY *Captain W. W. Waite*

SCHOOL SHOP's editor asked the Signal Corps what methods teachers of pre-induction training should use in order to be of most help to the prospective soldier. Herewith Captain Waite answers that methods aren't as important as results! Train every student and train him thoroughly is what the Army wants.

A Signal Corps soldier at Ft. Monmouth, N.J., wiping a joint on a lead-covered cable as part of post-induction training.

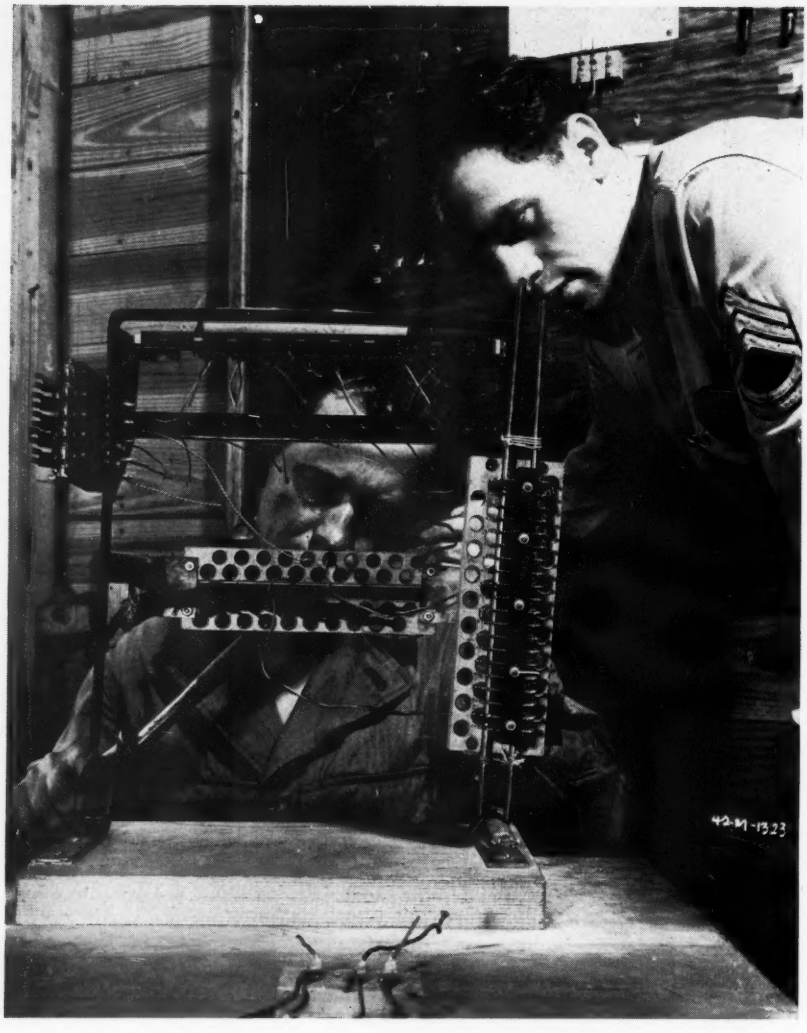
THE armed forces are in need of a large number of men trained as specialists in a variety of fields. Today, as never before in history, members of the Army, Navy, Marine Corps, Air Forces, and Coast Guard must not only be able to perform complex tasks well, but they must be able to perform them in the stress of battle, under all kinds of weather conditions, day or night, and frequently without all the tools and equipment to which they have been accustomed. Though this article will concern itself solely with the requirements of the Signal Corps, it must be borne in mind that the specialists mentioned are used in many other branches of the Army and, under somewhat different designations, in the Navy and other organizations.

It cannot be emphasized too strongly that the primary requirement and the ultimate test of a man's training is his ability to perform his job. This ability cannot be developed overnight, even in the less complex specialties. Repetition of the job under a variety of operating conditions is the essence of good training. The radio repairman, for example, must clear all kinds of trouble developing in the equipment supplied to his unit. He must clear these troubles repeatedly until, through experience, he acquires the ability to analyze problems quickly and diagnose troubles correctly. He must develop manual dexterity and be able to handle his tools with a minimum of lost motion. He must be able to perform his job in darkness because he may be called upon to repair a balky radio set in some location where even a tiny flash of light would betray the position of a command post to the enemy and bring forth a tornado of fire. He must practice his work frequently enough that he does not become nervous under pressure.

The details of radio repair work, radio operating, wire equipment maintenance, and other specialties are taught to soldiers after they become members of the Army, but a great deal of time can be saved and the practical training facilitated by pre-induction training in trade, vocational, and high schools. This pre-induction training will be most valuable to the Army if the students acquire sound knowledge of the fundamentals of the subjects taught.

The basic subjects for which the Signal Corps has its greatest requirements may be divided into two groups. Fundamentals of Electricity, Fundamentals of Shop Work, and Fundamentals of Radio comprise the first group; and a knowledge of International Morse Code and the ability to use it under adverse conditions are included in the second. In both cases, the subjects are arranged in the order in which they should be taken up, and no student should be permitted to advance until he has thoroughly mastered each subject.

A knowledge of the fundamentals of electricity is basic to all radio repair work and to most wire communication equipment maintenance work. The methods used to develop such a knowledge do not particularly concern the Signal Corps as long as the student understands the subject material and is able to apply his training. The War Department, in cooperation with the United States Office of Education, has prepared a series of Pre-Induction Training Course outlines, one of which (PIT-101) is an excellent guide for instructors in basic electricity. Lectures, demonstrations and laboratory exercises are brief and any experienced science or vocational instructor can follow them without difficulty. Text references and



A technical sergeant instructor at Ft. Monmouth, N.J., teaching an enlisted man to wire circuits on a switchboard. (Photo by U.S. Signal Corps.)

visual aids are included.

Inasmuch as all Signal Corps mechanics are required to use tools, a knowledge of fundamental shop practice will stand the inductee in good stead. Pre-Induction Training Course No. 103 will be found valuable in conducting this type of training. Special emphasis is placed by the Signal Corps training schools, and should be placed by the pre-induction training establishments, on the proper use, care, and maintenance of tools. There are no hardware stores on Guadalcanal and tool replacements, as well as initial supplies, must be transported from the United States, so it behooves all tool-using personnel to take the best possible care of their equipment. Furthermore, an eye can be removed almost as neatly by a slipping screw driver as it can by a machine-gun bullet, and a soldier in the hospital is more of a liability to his unit than one who has been killed.

A soldier assigned to a Signal Corps radio repair school will progress a great deal faster if he has a knowledge of the fundamentals of radio, acquired before his entry into the military service. Students can include in their pre-induction work Course No. 201, which covers the fundamentals of radio.

The study of radio operating will be much easier, if the soldier has studied the International Morse Code in high school. A basic radio code course which is described in Pre-Induction Handbook No. 301 has been placed on phonograph records and can be taught by almost anyone. It does not require that the instructor be an expert radio operator or that he even be familiar with the code. An average student can progress in 70 to 90 hours' practice to a speed of 10 words a minute. Code instructors in Signal Corps schools have found that one of the best ways to teach International Morse characters is to emphasize that they are in reality the fundamentals of a new and unfamiliar language. No students are permitted to write dots and dashes. In fact, the words "dot" and "dash" are not even used, but the words "dit" and "da" are substituted and students are encouraged to converse with each other by means of these sounds. The counting of sounds is strongly discouraged and every effort is made to develop in the students the ability to recognize "dididadit" as "F," just as they write the letter "W" when they hear "doubleyou." Inasmuch as radio operating in the Army is carried on under any and all conditions, the students will benefit if they have an opportunity to receive code messages in locations where the noise level is high and minor distractions are frequent.

When a selectee, who has taken pre-induction training in any of the subjects discussed, is assigned to one of the Signal Corps schools, he will find that the rate at which he progresses will depend entirely on his own ability. He will not be required to repeat any material on which he can pass the regular examination. The objective of these schools is to graduate qualified specialists as quickly as possible after they enter. As mentioned previously, the ultimate test which the student must pass is the ability to do his job, and for that reason, practical training is emphasized. The men work on regular Signal Corps equipment, and during the latter part of the instruction period, are taken to field training installations in which actual combat conditions are closely simulated.

Repetition of the job is the watchword and the men perform their duties over and over until proper performance becomes habitual and they can carry out their assignments regardless of noise, danger, weather, and other conditions. Furthermore, the soldiers are taught that they cannot rely on having factory-built equipment in a satisfactory state of maintenance at all times. Emphasis is placed on the ability to improvise substitutions for parts which have been damaged, lost or destroyed. Communication equipment which goes out of service must be restored in the shortest possible time in order to get vital messages through. The man who is unable to repair equipment without a complete set of tools and spare parts is not as much of an asset to a unit in battle as the man whose imagination, ingenuity, and skill enable him to improvise substitutes and restore vital communication service.

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Coordinated Shop Program *for Model Building*

BY *E. E. Miller*

The author and students in group instruction. Blackboard demonstration in the background.

THE WAR and predictable postwar trends have highlighted two major problems of the industrial arts teacher. First, to organize shop teaching in the light of present-day industrial practice; and, second, to integrate the work of the individual shop with the other shops in the department and, just as important, with other school subjects . . . science, mathematics, art, etc.

These two problems were kept to the fore in planning the Navy-sponsored model plane program carried on at Western Hills High School. Aviation as a whole has presented an excellent opportunity for the coordination of shop, mathematics, and science departments. The science and mathematics departments supply the fundamental theories and formulas of flight and aviation; the shop furnishes the concrete demonstrations and projects that bring the theory home to the student.

The making of solid model airplanes lent itself admirably to the illustration of industrial production technics. As will be seen by the detailed description of our program, this approach enabled the attainment of a large number of educational objectives, while at the same time opening for the students the door to the world of aviation in which we now live.

Objectives attained include:

1. Accurate working to close tolerances.

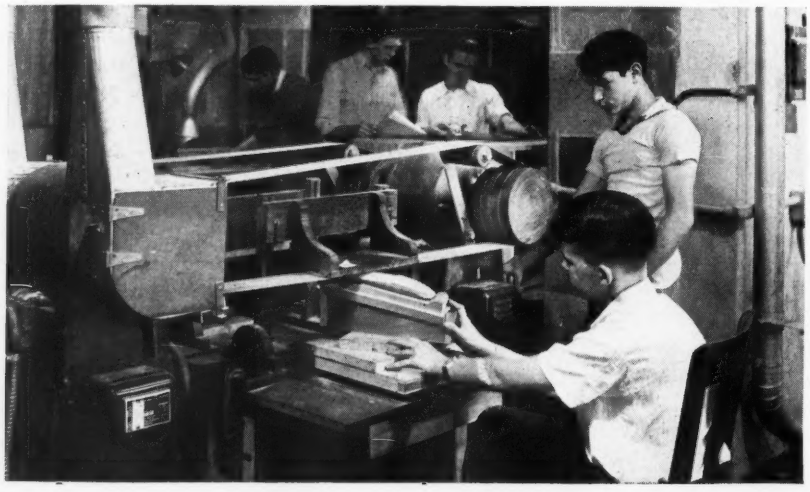
After completing the task of supplying the Navy with model planes, the next logical step is to go beyond this program into the construction of flying, powered, and radio-controlled models and glider building. This article explores the educational possibilities of the model-building and glider programs. E. E. Miller is head of the industrial arts department, Western Hills High School, Cincinnati, Ohio.

2. Close group cooperation.
3. Coordination of departmental activities.
4. Development of manual skills.
5. Close simulation of actual factory situations and conditions.
6. Reduction of student drudgery.
7. Increase in time for individual instruction.
8. Reduction of waste to minimum.
9. Varied machine practice.
10. Holding interest of class.
11. Student instruction and participation in systematic procedure for solving a practical construction problem.

Dealing with seven different models, we organized the shop on a production basis. Geometry and trigonometry were applied in finding the different radii, angles, and axis points necessary before certain jigs and fixtures could be constructed to hold the minute pieces used in the models. The drawing department cooperated in designing the jigs and planning the machine set-ups. An automatic lathe head and a duplicating machine are now being worked on to further facilitate production and simulate factory methods.

Production was organized in four one-hour shifts, a different class participating in each. Each boy had a specific task for his hour's work. Stock boys were selected to supply material. Foremen were chosen to supervise the production.

Machine set-up with two sanding belts running between two lathes set parallel. Using the jig, the operator presses the work against the belt and shoe with a foot pedal. Eliminates much hand work.



Representative procedure sheet used in the model-building program.

MITSUBISHI "96"
Procedure Sheet

LATHE: Turn out fuselage.
HAND: Cut away excess windshield; cut out wing slot; cut front and rear curves on wing.
BAND SAW: Slab off dihedral.
DISC SANDER: Sand airfoil.
MITRE BOX: Cut dihedral across airfoil.
BAND SAW: Cut out fin and stabilizer.
DISC SANDER: Sand cockpit cover.
JIG SAW: Cut out landing struts.
HAND: Glue wheel pants cover.
Attach wing to fuselage.
Glue cockpit cover and tail assembly to fuselage.
Mold on fillets.
Glue on landing struts.
Finish; check; sand.
Score in cabin, turret, and wing and tail flaps.
Spray with blackboard slating.
Resand lightly.
Rub; spray second coat.
Pack according to specifications.

Benches were set in two rows for assembly-line purposes. Center aisle is used for inspection. Shelves above used for storage of materials and jigs not being used.

With the help of the electricity department, we are working on radio-controlled gasoline-powered planes which will carry the program well beyond the solid-model stage.

Thus with the cooperation of the science and mathematics departments and the wood, metal, electrical, and drawing shops, the students receive a complete groundwork in aviation tying in well with their pre-induction training.

In the future, with similar coordination of other departments, a more flexible program is expected which will allow greater student specialization in specific fields of interest. The problem of motivation and student interest is thus automatically taken care of. Yet the manipulative skills taught by the individual project method in the past are still kept in the foreground.

Further departmental cooperation is expected to be developed in such lines as aircraft glider construction, machine design, model building, home planning, furniture design, and stage craft. An example of the possibilities of this is shown in the field of glider building:

Drawing: The drafting department will produce full-size and scale plans for jigs and fixtures, for parts, and for assembly uses.

Woodworking: This department will make jigs and fixtures; make parts; and assemble the gliders, including the fitting of fabrics, spraying, and control assembly.

Metalworking: The metal shop will supply all metal parts needed both for gliders and for the jigs and fixtures.

Science: The science department will study flight, air currents and their causes and effects, and other basic aviation principles.

Mathematics: Mathematics is necessary in the calculation of stress, drag, resistance, etc., on the glider parts, as well as in the study of flight itself.

Essential Books

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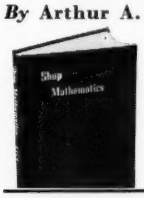
By **Arthur A. Dick, M. A.,** ***Coordinator, Vocational War Production Training, for Baltimore County, Maryland***



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Shop Student Personnel Organization

BY *Edward Stein*

Paralleling the shop organization of industry, the author has evolved a method of class organization that relieves the teacher of many minor responsibilities and, in addition, develops leadership and responsibility in students. Teachers with large classes will find this device particularly helpful. Edward Stein is an instructor in sheetmetal work in the McKinley Vocational High School, Buffalo, N.Y.

WHEN classes are large and the maximum amount of teaching efficiency is desired, a smooth running and dependable student personnel organization will relieve the teacher of many small but important shop details. At the same time the students share in the responsibilities of keeping the shop running efficiently and allowing more time for instruction and attention from the teacher. A good student personnel organization will eliminate most disciplinary problems, tool loss, waste of time, waste of materials, and help to develop those habits of order, neatness, system, and responsibility that are necessary more than ever today.

As shown in the diagram, the organization is modeled along industrial lines using the various supervisory designations. The personnel at all times is responsible to the instructor. As smooth running as the organization may be, the instructor must be in control at all times. At the end of the first quarter of the term the personnel is selected on a basis of scholarship, leadership, and interest. By keeping his scholarship above 90 average the student retains his position. Practically all of the personnel make an effort to keep their titles. A lowering in scholarship means a demotion while an increase in scholarship rating at the end of each quarter warrants a promotion.

Those pupils not included in the personnel organization are the workers or mechanics and the opportunity is always available for promotion into the organization if their scholarship and interest warrants advancement. All pupils regardless of position rotate through the toolroom assignments. Extra credits are given to those members of the organization who perform their duties well and show capacity for leadership.

Badges are worn at all times by personnel members to indicate rank. The diagram shown below is posted on the bulletin board with the student's name inserted under his title. The entire organization has bi-monthly meetings with the instructor to discuss improvements that may be made. The key members of the organization—superintendent, foreman, and leadmen—meet monthly with the instructor to discuss pupil and organization cooperation and suggestions are made for the good of the entire class.

At the close of each class period the various inspectors report O.K. conditions under their supervision to their leadman, who in turn reports O.K. conditions to the foreman and superintendent, who in turn report O.K. conditions to the instructor before the class is dismissed. The toolroom overseer reports directly to instructor on toolroom O.K.

Each leadman has eight students under his jurisdiction or in his unit or section and is responsible for the normal progress of his group. One of his duties is to keep the group up to the required amount of work to be accomplished at the end of each quarter. The foreman and instructor assist with the slower pupils in each group. The superintendent, in addition to his supervisory duties, gives all-round assistance when necessary. The foreman repeats demonstrations when requested to do so by a leadman. He also assumes the superintendent's position when the superintendent is absent.

The duties of the shop personnel organization are as follows:

Duties of Shop Student Personnel Organization

Superintendent.—Assume charge of room when instructor is out of room. See that everyone keeps busy when instructor has visitors. Keep order in washroom. Line up pupils for dismissal. Keep class in order when marching through halls. See that everyone does his appointed task. Line up class for fire drills. Give clean-up signal.

Foreman.—Assist superintendent in lining up classes. Help boys who are behind in their work by demonstrating use of machines and tools. Prevent wasting of materials by students. Acquaint new boys with the shop procedure.

Leadman.—Assume responsibilities of seeing that the workers in his section progress as rapidly as possible by giving his assistance. Refer boys to foreman for additional demonstrations. Give boys necessary materials and see that materials are conserved, such as sheetmetal, wire, and solder. Report students who violate shop rules.

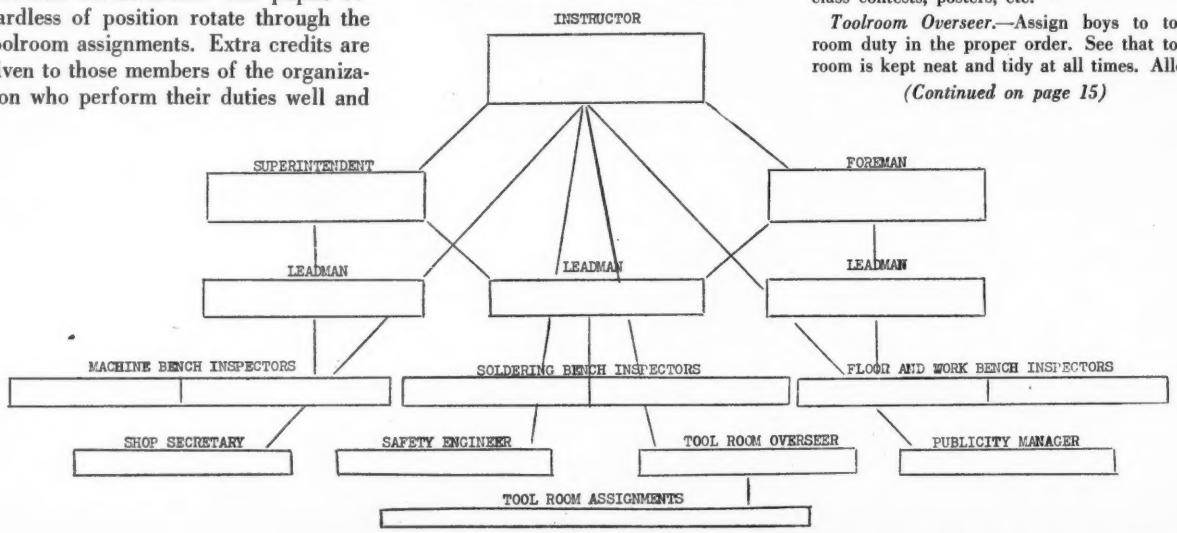
Shop Secretary.—Call the roll. Read all bulletins and notices pertaining to class activities, assemblies, etc. Collect all tardy and absence excuses.

Publicity Manager.—Take care of all ticket campaigns and work for success of same. Give class publicity wherever possible, such as interclass contests, posters, etc.

Toolroom Overseer.—Assign boys to toolroom duty in the proper order. See that toolroom is kept neat and tidy at all times. Allow

(Continued on page 15)

SHOP STUDENT PERSONNEL ORGANIZATION



7 things you should do to keep prices down!

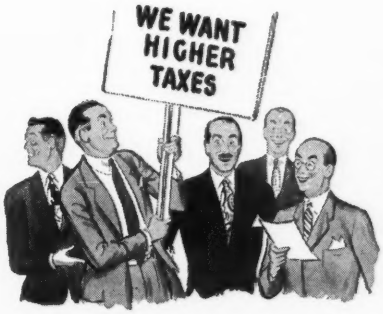
If prices soar, this war will last longer, and we could all go broke when it's over. Uncle Sam is fighting hard to keep prices *down*. But he can't do it alone. It's up to *you* to battle against any and every rising price! To help win the war and keep it from being a hollow victory afterward—you must *keep prices down*. And here's how you can do it:

1. BUY ONLY WHAT YOU NEED

Don't buy a *thing* unless you *cannot* get along without it. Spending can't create more goods. It makes them scarce and prices go up. So make everything you own last longer. "Use it up, wear it out, make it do, or do without."

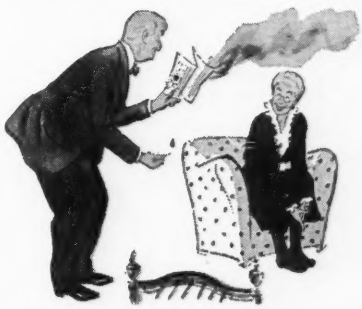
2. PAY NO MORE THAN CEILING PRICES

If you do pay more, you're party to a black market that boosts prices. And if prices go up through the ceiling, your money will be worth less. Buy rationed goods only with stamps.



3. SUPPORT HIGHER TAXES

It's easier and cheaper to pay for the war as you go. And it's better to pay big taxes *now*—while you have the extra money to do it. Every dollar put into taxes means a dollar less to bid for scarce goods and boost prices.



4. PAY OFF OLD DEBTS

Paid-off debts make you independent now . . . and make your position a whale of a lot safer against the day you may be earning less. So pay off every cent you owe—and avoid making new debts as you'd avoid heiling Hitler!

5. DON'T ASK MORE MONEY

in wages, or in prices for goods you have to sell. That puts prices up for the things all of us buy. We're all in this war together—business men, farmers and workers. Increases come out of everybody's pocket—including *yours*.

6. SAVE FOR THE FUTURE

Money in the savings bank will come in handy for emergencies. And money in life insurance protects your family, protects you in old age. See that you're ready to meet any situation.

7. BUY WAR BONDS

and hold them. Buy as many as you can. Then cut corners to buy more. Bonds put money to work fighting the war instead of letting it shove up prices. They mean safety for you tomorrow. And they'll help keep prices down today.

KEEP PRICES DOWN . . .

Use it up . . . Wear it out . . .

Make it do . . . Or do without.

This advertisement, prepared by the War Advertising Council, is contributed by this magazine in cooperation with the Magazine Publishers of America.

TAPER TURNING

BY *David T. Armstrong*

This is a review of an important aspect of machine-shop training sometimes hurried over by instructors. It offers the opportunity to discuss related mathematics. The author teaches in the Weehawken, N.J., schools.

So many young people are being introduced to machine-shop practice today that the difficulty they have understanding the simple mathematical principles of tapers makes a review of the facts timely.

Sometimes a taper is a complete cone, as in a 60° center point, or a needle valve point. More frequently, however, a taper is a truncated cone, i.e., the bottom section of a right cone cut off by a plane parallel to the base at some point below the apex of the cone. In geometry this solid is called a frustum. The diameter of the taper at any given point will be a function of its length. The longer the piece is, the greater its diameter at the large end.

Any cylinder turned to an angle of less than 90° or greater than 0° is a taper. By this reasoning those parts of the headstock and tailstock centers on which the work is fixed are tapers, 30° tapers. The included angle of a center is 60°, but the angle of a taper is usually measured from the center line.

Tapers may be cut on a lathe in a number of ways: by setting over the tailstock, by using the compound rest, by using a flat-nose forming tool, or by using a taper attachment. For a taper cut by setting over the tailstock the set-over of the tailstock must be equal to one-half the difference in diameters between the two ends of the taper, calculated for the whole distance between the centers. With respect to the extent and location of the taper there are three possible cases:

Case I. When the taper extends for the entire length of the piece:

Suppose a bar 24″ long is to be turned to a taper 2″ in diameter at one end and 4″ in diameter at the other end. It will be necessary to set the tailstock over ½ of 2″, or 1″. See Figure 1.

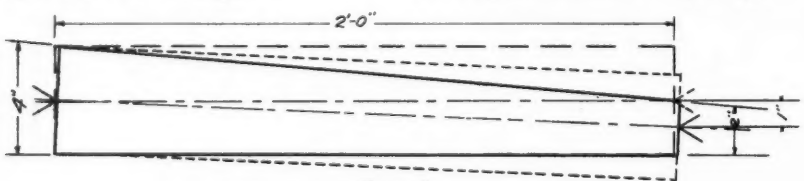


Figure 1.

Case II. When the taper extends for only a portion of the entire piece:

Suppose a bar 24″ long is to be turned to a taper 2″ in diameter at one end and 3½″ in diameter 12″ from the small end. The taper is 1½″ per foot or 3″ in 24″. Therefore the diameter of the large end of the piece, if the taper were calculated for the entire piece, would be 5″. It would be necessary to set the tailstock over ½ of 3″ or 1½″. See Figure 2.

Case III. When the taper is not at either end, but somewhere between the ends:

Suppose a bar 24″ long is to be turned to a taper having a diameter of 2″ at a point 4″ from one end and a diameter of 4″, 12″ from the same end. This is a taper of 3″ per foot. Since we are dealing with a 2′ bar, the diameter at the small end, if the entire bar were tapered, would be 1″ and the diameter of the large end would be 7″. The tailstock offset to cut such a taper would have to be ½ of the difference in diameter at both ends, or ½ (7—1), or 3″. See Figure 3. But the tailstock could not be set over 3″. Such a taper would have to be made by another method, i.e., a taper attachment or by using the compound rest.

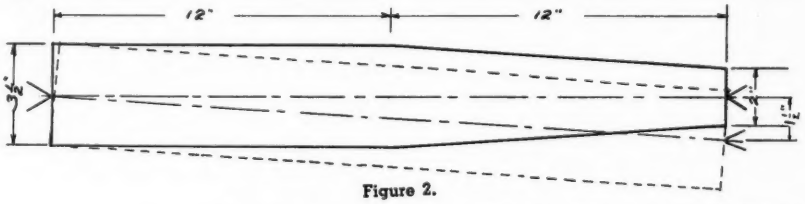


Figure 2.

One of the perplexing problems which confronts the young machinist is the manner of determining the tailstock set-over. The method to be used depends on what is given as working data. The following information covers all of the ordinary cases that will arise in the general shop:

Method I. When the diameters at both ends of the taper are known or can be readily determined:

The method of determining the tailstock offset when the diameters at both ends of the taper are given, or can be readily determined, involves the formula:

$$\frac{\text{Diameter at the large end Minus Diameter at the small end}}{2} \text{ Multiplied by } \frac{\text{entire length of the piece, or, the distance between the centers in inches}}{\text{Length of the tapered portion}}$$

The reason for specifying the distance between centers in inches is that the work may be on a mandrel. It is the distance between centers that is important, not the length of the piece of work. For very accurate work the exact distance between center points is determined.

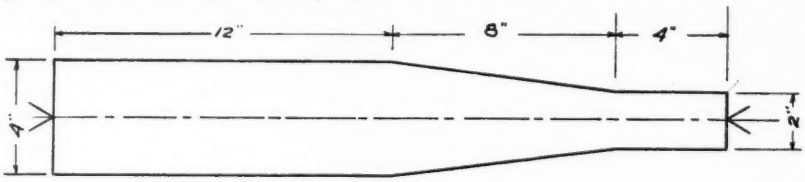


Figure 3.

Thus, if both the headstock and tailstock centers penetrate the work for a distance of ¼″ each, the nominal length of the work piece will be ½″ less. To make the examples as simple as possible, this factor has been eliminated from the following problems.

The above formula is usually abbreviated to

$$\frac{D - d}{2} \times \frac{L}{l}$$

For Case I above we should have

$$\frac{4 - 2}{2} \times \frac{24}{24} = 1''$$

For Case II above we should have

$$\frac{3\frac{1}{2} - 2}{2} \times \frac{24}{12} = 1\frac{1}{2}''$$

For Case III above we should have

$$\frac{4 - 2}{2} \times \frac{24}{8} = 3''$$

Method II. When the taper per foot is given:

The method for determining the tailstock offset when the taper per foot is

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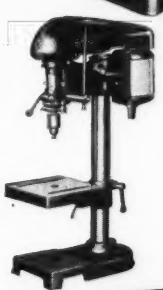

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given involves the use of the following formula:

$$\frac{1}{2}\,\frac{\text{Taper per foot}}{12} \times \text{distance between centers in inches.}$$

This formula is usually abbreviated $\frac{T}{24} \times L$.

For Case I we should have

$$\frac{1}{24} \times 24 = 1''$$

For Case II we should have

$$\frac{1\frac{1}{2}}{24} \times 24 = 1\frac{1}{2}''$$

For Case III we should have

$$\frac{3}{24} \times 24 = 3''$$

Method III. When the taper is given in degrees:

The taper which is given in degrees can be changed to taper in inches per foot by determining the tangent of the angle. The illustration in Figure 4 will help make clear the manner of determining the taper per foot or the taper per inch when the taper is given in degrees. It is necessary to have the taper per inch or taper per foot to calculate the offset for lathes not equipped with a taper attachment, because it is possible to set over the tailstock accurately on such a lathe only by using the micrometer collar on the cross feed which is graduated in thousandths of an inch.

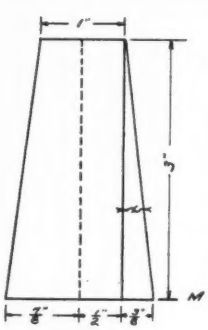

Figure 4.

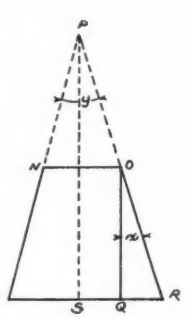

Figure 5.

In Figure 4, since we have given the diameter at both ends of the piece we know the taper per foot is 3″ and we know the taper per inch is ¼″. When the taper is given in degrees, it is important to ascertain whether the taper is given as the size of the included angle, or as one-half the included angle. Thus, in order to determine the taper per inch when the taper is given in degrees we shall have to know the tangent of angle x. The tangent of an angle is the relationship of the

$$\frac{\text{side opposite the angle}}{\text{side adjacent to the angle}}$$

In Figure 4, the tangent of angle x is $\frac{\frac{3}{8}}{3}$ or .125. Using the table of tangents we discover that .125 is the tangent for 7° 7′ 30″. If the value of the angle with the center line had been given as 15°, the tangent of the angle, or one-half the taper per inch would be .26795. The tangent of an angle as given in the table of tangents is the ratio of the side opposite the angle (calculated on the basis of unity) as compared to the value of the side adjacent to the angle. The tangent of an angle is in reality a quotient. This is the value of the angle one side of the taper makes with the center line. Twice the tangent of the angle with the center line is the taper per inch. See Figure 5.

Sometimes the value of the angle given is the included angle. This is illustrated in Figure 5 in which the manner of determining the values of both angles and both tangents is shown. The tangent of the included angle for a taper of 3″ per foot would be .250 or the quotient of $\frac{3}{12}$, and the size of the angle, according to the table of tangents would be 14° 2′ 10″. There may seem to be a slight discrepancy here because it may be expected that when you double the size of the angle you also double the size of the tangent, or twice the tangent of angle x is the tangent of angle y. An examination of the table of tangents will show, however, that the tangent of 10° is .17633 while the tangent of 40° is .83910, or almost five times as great. The demonstration of the proof of the fact that the tangent of an angle is always numerically greater than twice the tangent of half the angle, for angles between 0° and 90° is beyond the scope of this article. However the fact that the tangent of an angle is 0 for 0° and approaches infinity for 90° should indicate by common sense that we are not dealing with simple ratios but rather progressive ratios which increase slowly at first and then mount quite rapidly as we approach 90°. Thus in Figure 5 the tangent of angle y, represented by the line MR is numerically greater than twice the tangent of one-half angle y, represented by the line SR.

It is for this reason that the tangent of the included angle is calculated as twice the tangent of the angle the taper makes with the center line. Another way of saying this is that the tangent of the included angle is twice the tangent of half the included angle. Thus the tangent of 7° 7′ 30″ is .125 which is the ratio of $\frac{\frac{3}{8}}{3}$ as per Figure 4, and the tangent of 14° 15′ is .250, or twice the ratio of $\frac{\frac{3}{8}}{3}$ as per Figure 4. What we are actually doing is taking the tangent of the angle with the center line for both sides of the tapered piece and adding them.

If, then, the taper is given in degrees for the included angle, say 14° 15′, in order to determine the taper per foot and the offset for the tailstock, we must determine the tangent of one-half the included angle, which is 7° 7′ 15″. The tangent of this angle is .125. This is one-half the taper per inch or 1/24 the taper per foot. The tangent of the angle is always one half the taper per inch because the side adjacent to the angle is always regarded as unity to determine tangent ratios. Thus, when the taper is given in degrees, the tailstock setover will be the product of the tangent of one-half the included angle and the distance between centers in inches. If, then, a taper is given as 1° 29′ 30″ (the angle with the center line) and is to be uniform on a piece 6″ long, the tailstock setover will be 6 × .02604. The tangent of 1° 29′ 30″ is .02604 and the distance between centers is 6″. Therefore the tailstock setover is .156.

How to Determine the Taper As a Percent

This is a very desirable technique because the percent figures are on the circumference of the greatest circle on a taper attachment. The graduations on the percent circle are farther apart than the graduations on the taper in inches per foot circle, or the taper in degrees circle, and hence are easier to read.

Condition I. When the taper is given per inch or per foot:

A taper of ½″ per foot would be a taper of .500 inches per foot. This would be a taper of .04175 inches per inch, or a little less than a taper of 4.2 percent. The taper as a percent is always computed on the basis of the taper per inch.

Condition II. When the taper is given in degrees:

When the taper is given in degrees it is a very simple matter to determine the percent of taper. Let us suppose that the taper is given as 7° 7′ 30″. The percent of taper is calculated on the basis of the tangent of the included angle, which as we have seen is twice the tangent of the angle with the center line. The taper expressed in degrees is usually given as the value of one-half the in-

cluded angle. The tangent of 7° 7′ 30″ is .125. Twice the tangent of this angle gives us .250 as the basis for determining the percent of taper. Multiplying this by 100 gives us the percent of taper for an angle of 7° 7′ 30″ as 25 percent. The percent of taper for an angle with the center line of 1° 29′ 30″ is 100 times twice the tangent of this angle or 100 (2 x .02604) or 5.2 percent.

The value of determining the taper as a percent is that the first setting will be most nearly accurate since there is about ⅛″ space for each 1 percent on the scale. This facilitates the turning or grinding of accurate tapers with a minimum amount of adjustment or readjustment.

Methods of Turning Tapers

There are three common methods of turning tapers on a lathe:

Method I. By using the compound rest:

This method is applicable to turning and boring. The most practical way to cut a taper using the compound rest is to determine the taper in degrees. The 60° tapers on the points of the headstock and tailstock centers are usually turned on a lathe by using the compound rest. They may also be turned by using a flat-nose forming tool.

Method II. By using a taper turning attachment:

This method may be used for turning and boring. The most practical way to cut a taper using the taper turning attachment is to determine the taper as a percent and set the taper attachment to the correct percent to cut the desired taper. At the present time the cylindrical grinder is the only machine I am acquainted with that has a taper attachment calibrated in inches per foot, degrees, and percent of taper.

It is important that the movement of the cross slide be opposite in direction to the direction of pressure on the cutter. There is some backlash in the sliding block in the taper attachment on a lathe. Observing the rule suggested here forces the siding block against one side of the guide plate and keeps it there throughout the cut. Failure to observe this suggestion will result in the steps sometimes encountered in taper turning.

Method III. By setting over the tailstock:

The following methods are suggested for setting over the tailstock to cut accurate tapers:

Method A. Using the micrometer collar on the cross feed:

Let us suppose that it is desired to cut a taper that necessitates a tailstock setover of .181. It is impossible to measure this distance accurately with a steel scale by setting the point of the live center on one side of the scale and the point of the dead center on the other side of the scale. Neither is it possible to measure this distance accurately by determining the distance between the zero lines on the rear of the tailstock.

But we can measure this distance accurately by fixing the tool holder in the tool post, turning out the footstock spindle far enough to have the side of the tool post almost touch the footstock spindle. The use of a feeler gage to determine that the tool post almost touches the footstock spindle will facilitate the operation. If no feeler gage is available a piece of paper will do as well. Take a reading on the micrometer collar on the cross feed. Draw the cross feed away from the footstock .181, by using the graduations micrometer collar. Be sure t allowance for the backlash of the cross feed screw. If the last feed of the screw was in, withdraw the cross feed about .225 and feed in until it has been withdrawn .181. Now set the tailstock over

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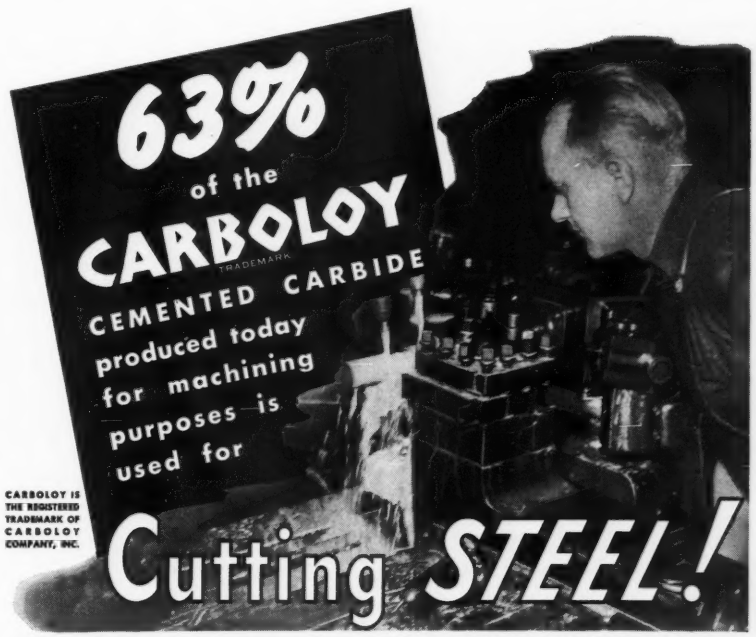
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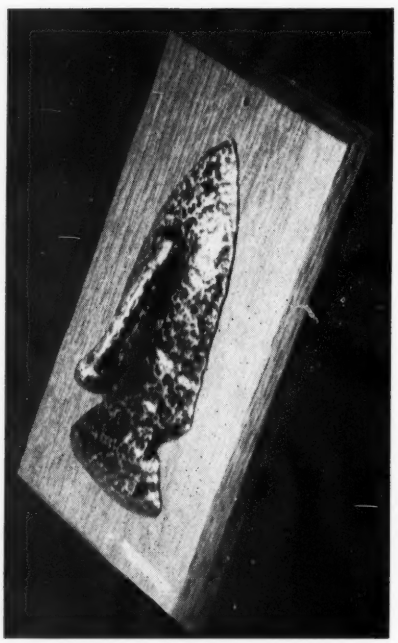


For teaching the elements of hand forging, this little project will work admirably. It has the added advantages of utility and basic student interest. A. J. Brezina is a student at Oswego, New York, State Teachers College.

MANY a school boy has no doubt sometime in his life taken a fancy to Indian relics, especially arrowheads. Here is a project that not only appeals to students because of their interest in Indian lore, but also provides many fundamental procedures in forge work.

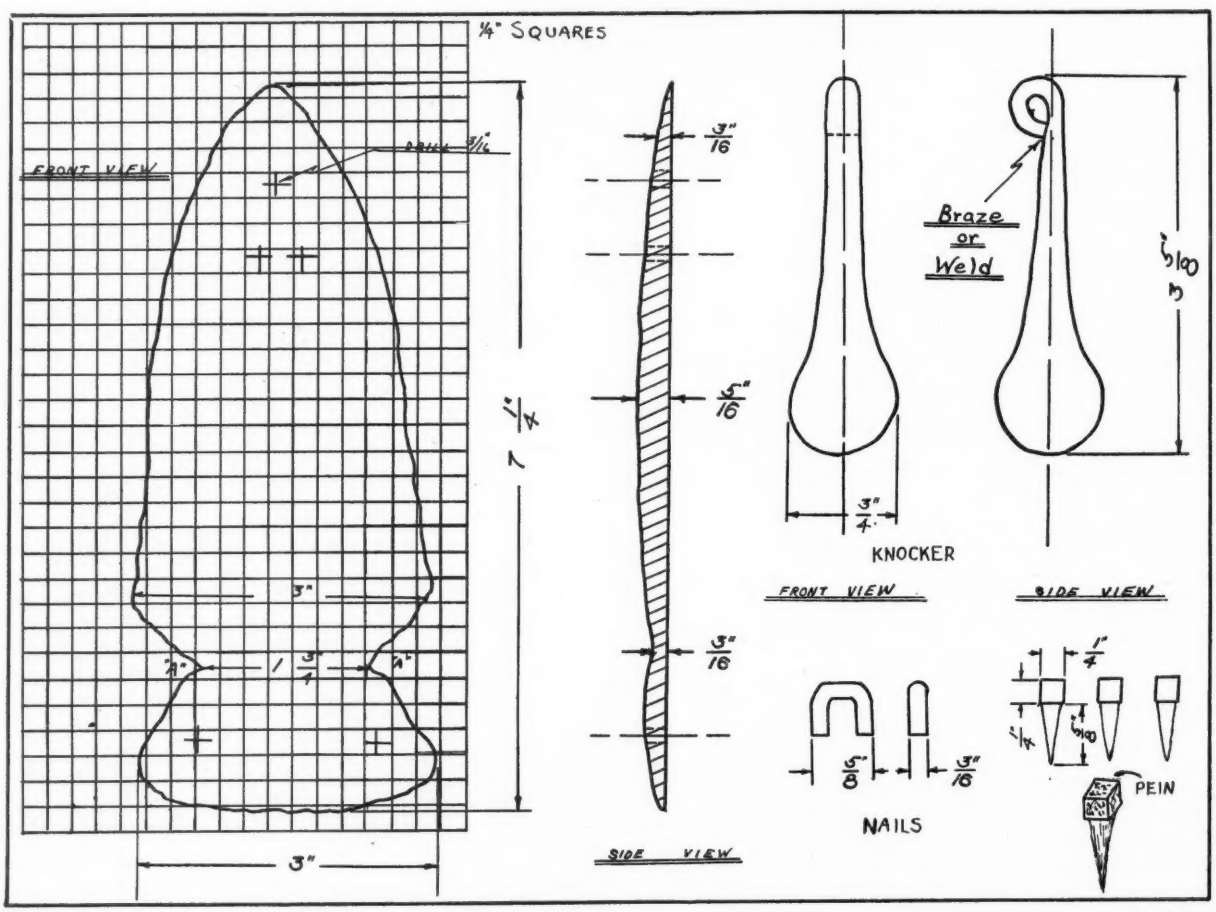
The project, an arrowhead-war club door knocker, is made from cold rolled steel 5/16" × 2½" × 6½". The clapper, in the form of an Indian war club, is made from ¾" × 4" C. R. S.

Begin by making a general pattern of the arrowhead on a piece of paper or cardboard. The outline may then be transferred to the steel stock by means of punch marks.

Heat the stock to a full red heat and begin to cut away the excess stock by means of the hot cut chisel. Do not try to do any cutting when the stock cools. After the general shape of the arrowhead has been formed, work may then be started on the base of the arrowhead. With the top and bottom fuller form the notch as in the diagram at point *A*.

Now that the preliminary forging of the arrowhead has been completed any rough irregularities may be ground off on a grinder.

Then begin the peening of the surface of the arrowhead. The arrow is high in the middle and gradually tapers down to each side and also the front and back. The purpose of the peening is not only to aid in the final shaping of the arrowhead, but also to reproduce the flake design of real arrowheads. This adds the necessary realism to the project. Make the peen marks as irregular as



possible and vary the hammer blows so as to produce a broken yet attractive surface. The flakes, or peen marks, near the edge of the arrowhead are rather fine and become larger toward the middle of the arrow.

Make sure that the back surface of the arrowhead is flat when the final forging has been completed. Do not attempt any hammering or shaping while the metal is cold. This will only result in checks and cracks in the finished surface of the project. When all shaping and peening has been completed heat the arrowhead again and then let it cool slowly, thus producing a fine inner structure as well as an attractive surface.

In making the clapper, select a piece of cold rolled steel $\frac{3}{4}'' \times \frac{3}{4}'' \times 3''$. Begin by upsetting one end of the stock to produce the club end. Do not try to make it a perfect ball. It will appear more realistic if a little crude or rough. The ball should be about $\frac{3}{4}''$ in diameter. Of course the shape and diameter of the ball may be varied according to the desires of the individual. After the ball has been completed draw out the handle to the shape in the diagram. A loop is formed at the end of the handle. It may be either brazed, welded, or simply left slightly open. The clapper is also peened all over. A "U" shaped arrangement is made to receive the loop when the final assembly is reached.

The loop of the handle is first formed and then passed through the "U" nail. The loop may be forged tight, or brazed or welded. Then the "U" nail is passed through the arrowhead proper and is brazed or riveted to the back of the arrow.

The "U" shaped nail is drawn out of a piece of $\frac{1}{4}''$ cold rolled steel to a diameter of about 3/16". This is also peened and then given its final shape. The nails are also made from $\frac{1}{4}''$ stock. The student will enjoy designing his nails. Peen the tops of the nails.

The arrowhead is given a burnt oil finish and then highlighted with fine emery cloth. The finished product indeed possesses the flaky appearance of a true flint arrowhead. Finally lacquer. Should the arrowhead door knocker be used for display purposes it may be mounted on an oak plaque.

At the completion of the project the student should have gained experience in the following procedures: Forging, hot cutting, shaping, upsetting, drawing out, rounding out, peening, drilling, design, burnt oil finish, brazing or welding or riveting, lacquering, and others.

Personnel Organization . . .

(Continued from page 8)

no one but the toolroom keeper in the toolroom. Check with the toolroom keeper for proper amount of tools. Report all tools missing and in poor condition.

Safety Engineer.—Report any violation of shop safety rules. See that all safety devices and guards are used. Report any unsafe condition in the shop. Caution pupils about proper shop attire. Make suggestions to improve safety conditions. See that all injuries are given prompt first aid.

Soldering Bench Inspectors.—Morning inspectors will light furnaces. Afternoon inspectors will shut off furnaces. Shut off gas when fire alarm is sounded. See that soldering materials are not wasted. See that soldering equipment is kept in good condition and replenished—such as dip jars, acid cups, etc. Keep the soldering bench orderly and neat at the close of classes ready for use by the next class. Report waste of solder and sal ammoniac to foreman.

Machine Bench Inspectors.—See that stakes, stake holder, and machines are in proper places and neatly arranged at close of classes. Keep bench clean and clear of scrap and dirt. Keep wire coiled neatly and small machines in place. Report to foreman abuse of stakes and machines. Oil machines and stakes weekly.

Floor and Work Bench Inspectors.—See that floors and benches are cleared of scrap metal at close of classes, ready for use by the next class. Take care of opening and closing windows. Keep floors cleared under benches at all times. Oil bench machines and vises weekly.

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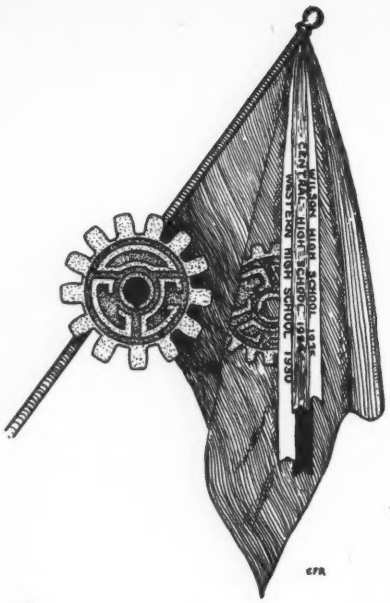

The Cog...

A CLUB FOR DRAFTING STUDENTS

BY *Edgar Farr Russell*

A club for high-school drafting students that contributes greatly to their acquaintance with industrial education subjects. The author teaches mechanical drawing at Central High School, Washington, D. C.

GRADUALLY, and not without a struggle, the manual arts subjects have gained a more highly respected part in the high-school curriculum. Among these vitally important subjects, which are even more necessary today because of the war, stands mechanical drawing. Sometimes, however, teachers miss profitable opportunities for imparting to their students more of the benefits of mechanical drawing.

One way of making certain that our drawing students derive the most advantages from the skills and habits learned in the classroom is for the instructor to foster a successful drafting club in connection with school work and in cooperation with the educational program of the school.

Such an organization is *The Cog*, an honorary mechanical drawing club, which has chapters in several of the high schools of Washington, D. C.

Many other high-school subjects have long had their values emphasized through the encouragement by teachers of extra-curricular activities which are connected with school work. Outstanding pupils from English classes frequently become members of the staffs of school newspapers or magazines. Language courses have been enriched through the participation of language students in foreign language clubs. Physics and chemistry classes often maintain science clubs for the further stimulation and education of their science pupils. *The National Honor Society* grants membership to those students of good character, who are also good students, taking an active part in school activities. In some schools the curriculum is so organized that actual graduation credit is granted for pupil-participation in recognized student activities.

The Cog was founded on April 4, 1924, a time before most of the present boys and girls in our high school were born. John Griffith Clary, who was then a student at the Central High School in Washington, D. C., was the founder. (Today Clary is an officer in the United States Army at Fort Bragg, N. C.). In 1924, Clary talked over his ambitions with Mrs. Page Taylor Kirk, his teacher, who, as a woman teacher of mechanical drawing, must have been considered quite a rare creature in those days. Mrs. Kirk approved of Clary's ambitions and ideas and added a lot of her own; together the two planned the structure of a successful club which has been in existence ever since.

As the years passed, other chapters of the club were installed in other high schools. An interested *Cog* alumni group grew up around *The Cog;* today there are hundreds of successful men who are engineers, draftsmen, scientists, shop foremen, army and navy officers, chemists, aviators, and business men, owing some of their achievements and happiness to the incentives of their high-school days in *The Cog*. At the Fifteen Years' Celebration Dinner, held on April 4, 1939, over a hundred of these alumni and members applauded while Clary, the founder, and Mrs. Kirk cut a huge *Cog* birthday cake.

How does *The Cog* function, and what are its goals and activities? The Constitution of the club states: "It is the purpose of this Club to promote good fellowship among the members of the Mechanical Drawing Department of the ——— High School, and to be of service to the Department and to the Club."

Since it is a "professional" club, there are certain requirements to be met before a student may become a member. He is required to earn a "B" or better as his drawing mark and to have completed at least one semester of work. After this, he must receive a favorable vote for admission into membership by three-quarters of the active members. If these requirements are met, the prospective member is then pledged to *The Cog* and is given a pledge pin. Before his actual initiation into the fellowship of the club, he must write a theme on a topic of his own choosing, but which must be related to such subjects as drawing, engineering, aviation, the Army, the Navy, chemistry, industry, or similar fields. The completed themes are bound into booklets and filed with the archives of the club. Low marks of the prospective member must be improved. He must work at some task for the betterment of his school or his drawing room.

The following pledge has to be memorized: "I do hereby solemnly swear to do all within my power to uphold the Constitution of *The Cog* in letter and in spirit, to further the interests of the club and to maintain the goodwill therein existing. This oath I will keep throughout my active membership and as an alumnus."

When Joe Cog has satisfied the above conditions, which usually take about six weeks after he has been pledged, he is initiated. The initiation ceremony, an impressive affair, is held during one of the regular bi-monthly meetings. Active members take turns in holding these meetings at their homes.

A teacher of mechanical drawing is the sponsor or faculty adviser of the club and he is present at these meetings. His position is that of a fellow-member, perhaps an elder brother whose word, in important matters, is considered worth hearing.

He is not a dictator. As far back as 1928, the Yearbook of the Department of Superintendents of the National Education Association recommended, "In considering the evaluation of student activities, emphasis has been laid on the specific and general objectives set for any educational endeavor. The very name 'student activities' stresses the im-

portance of spontaneity and initiative on the part of the pupil and decries by implication any domination on the part of the teacher. Sympathetic and tactful supervision is as constant a need in these activities as anywhere in the organization, and evaluation of any single activity will weight strongly the influence of the supervisor."

After the initiation ceremony the new member is given the club pin, a little solid gold cog wheel with 13 teeth, which stand for "Room 13," where *The Cog* was started, years ago.

The pledge pin, two concentric circles of blue and steel, is finished in the colors of the club, blue for the blueprint and steel for the metals of engineering and industry. There is a flag of blue with a silver cog in the center. A streamer is added to the flag for each school in which a chapter is installed.

To each chapter, when it is inducted, a charter is given. It is suitable for framing and display in the mechanical drawing room. There is no charter fee or induction cost to the new chapter. Each member, when he is initiated, receives a "shingle" or membership certificate. Most members frame these certificates and hang them up at home.

The activities of *The Cog* are many. Some of these are traditional, having been practiced since the origin in 1924. Other activities depend on present needs. Among the activities which are traditional is the Annual Exhibit. The best mechanical drawing plates are collected during the school year and are displayed in the late spring in the school or in a nearby public library. Drawings of nonmembers are selected, as well as those belonging to members. Toward the conclusion of the exhibit, which usually lasts about two weeks, prominent local engineers are invited to act as judges to select the best plates. These outstanding plates are awarded prize ribbons.

Another traditional yearly affair is the Christmas meeting. Announcements of this party are sent to all alumni. There is always a large group present at these Christmas meetings.

Annually at Thanksgiving and Christmas, *The Cog* pauses to remember the unfortunate of its community. Food of all kinds, canned goods, fruit, vegetables, meat, and sweets are collected for the needy. Clothes and toys are assembled at Christmas for these same families. It never ceases to be a surprise that a rather small group of boys can do so much when they are working as a group toward a definite goal. The membership of an active chapter ranges from 15 to 25 boys of all semesters.

Activities of the club, which may vary from year to year, include the organizing of baseball, football, basketball, and bowling teams. Every school year sees the formation of a team in at least one of these sports in which nearly every member takes part. Plays have been produced in which the boys have even taken feminine roles.

When Central High School was in need of a school flag for the auditorium, the members of *The Cog* at that school provided it. *The Cog* at Western High School always gives a Christmas present to the school. Profits made by *The Cog* from dances at Wilson High School are given by the chapter to the school.

If you, as an instructor in mechanical drawing, have had your interest aroused in *The Cog*, and feel that a chapter of this club would fit into the extra-curricular life of your school, write to the author of this article for information as to how a chapter may be installed in your own drafting department.

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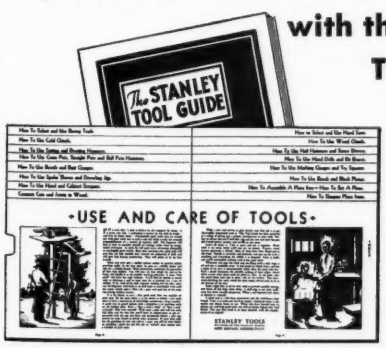

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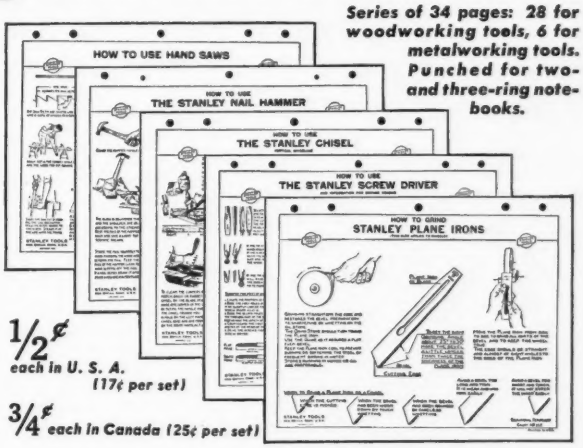
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Brief comments about **SCHOOL SHOP** *and the field it serves are invited. Address the Editor,* **SCHOOL SHOP**, *Ann Arbor, Michigan.*

Gentlemen:

When SCHOOL SHOP first appeared at my school, I immediately said it was exactly the magazine I had been looking for. I formed the habit of reading it from cover to cover until . . . I took my present position.

Going from the frying pan into the fire, I am afraid I must confess with a red face that I completely forgot the publication. At any rate, this morning a recent issue landed on my desk after having been forwarded to me by the principal of the high school. I have taken the time to look through it and realize how much I missed.

I should like very much to have you continue to send it to me at our plant.

W. M. McCORD,
Training Director
Curtiss-Wright Corp.
Louisville, Ky.

[SCHOOL SHOP *must* have your new address and teaching position when you change jobs. Please send it to us promptly as copies of SCHOOL SHOP cannot be forwarded to you by the post office.—*Ed.*]

Gentlemen:

Shop instructors were indeed fortunate when your publication began appearing in their classes. Your magazine has given me endless moments of valuable reading along with the excellent projects that have accompanied it. Many instructors have found time to bind them and I'm looking forward to finishing my second volume.

May I take this opportunity to sincerely thank all of your staff, from one who is indeed grateful.

JOHN GIOVANNI, JR.,
Coronel High School
Los Angeles, Calif.

Gentlemen:

Many thanks for the interesting, timely, and stimulating magazine you publish. Each issue makes a definite contribution to the teaching of industrial arts . . . we do appreciate the help you give us.

REUBEN SCHMITT,
Boude Storey School
Dallas, Texas

Gentlemen:

We enjoy your contents, articles, drawings, suggestions, and helpful ideas. Our students derive much from the projects illustrated and are ever on the alert for each new issue.

We thank you, SCHOOL SHOP, for coming to our classes.

CARL E. CAMMACK,
Union High School
Delano, Calif.

Gentlemen:

You may be interested to know that your magazine is always looked forward to by me, especially due to your live and practical topics —as well as acquainting me with some very useful teaching booklets and literature.

ARTHUR F. PETERSON,
Coolidge Junior High School
Natick, Mass.

Gentlement:

. . . Let me tell you that I enjoy each and every issue of SCHOOL SHOP and to date have found something that I can use in my school work in every issue . . .

R. E. DAHLEM
Tomlinson Vocational School
St. Petersburg, Fla.

Gentlemen:

Please accept my expression of appreciation for your magazine. The material set up in poster form is especially desirable, as is also the project material.

C. R. NEWTH
Highland School
Portland, Oregon

Gentlemen:

I enjoy reading your magazine and have made it available to our students. I think there is a decided need for such a publication as SCHOOL SHOP.

OSCAR E. GILLE
Burroughs Evening High School
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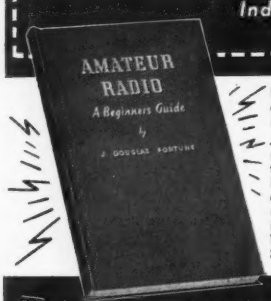

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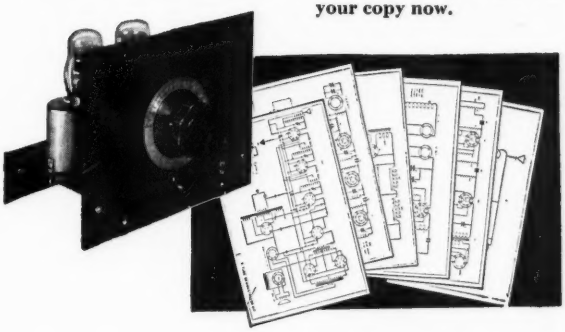

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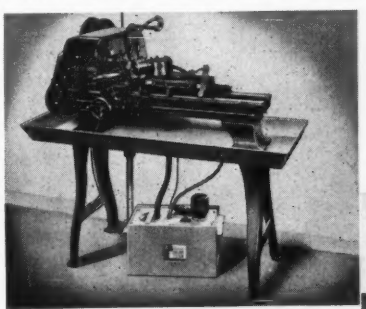

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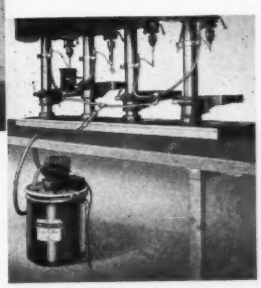

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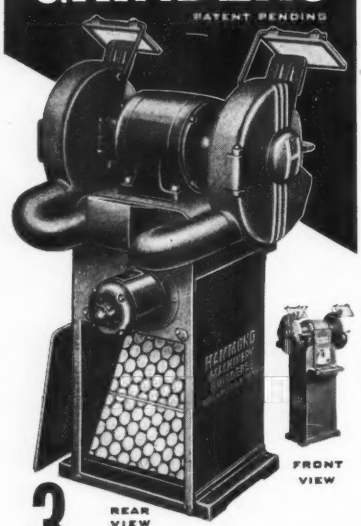

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news

WHAT'S DOING IN THE FIELD OF INDUSTRIAL EDUCATION

THE PART of vocational education in the pre-induction training program is set forth in War Department publication PIT-330, just off the press.

Entitled *Pre-Induction Training in Vocational Schools, Vocational Departments, and Trade Schools,* the 29-page booklet covers the details of the pre-induction program instituted this fall in the trade-and-industry field (see SCHOOL SHOP, June, 1943, p. 3).

The vocational PIT program differs substantially from the regular PIT program started last fall. Copies of PIT-330 may be had from the Office of Education, Washington, D. C. Supplementary bulletins for the assistance of vocational teachers in various fields are to be issued from time to time as the program gets under way.

THE WEEK of November 7 to 13 this fall has been set aside as American Education Week under the joint sponsorship of the National Education Association, the American Legion, the U. S. Office of Education, and the National Congress of Parents and Teachers.

"Education for Victory" is the theme of the week, which will be the twenty-third annual observance. Of interest to industrial educators are Monday, Tuesday, and Friday of the week, which are to concern Education for Work, Education for the Air-Age, and Meeting the Emergency in Education, respectively.

SALVAGED airplanes, equipment, and parts from Army Air Corps training fields and repair depots have been made available to schools for instruction in aviation and aircraft engine mechanics. Schools should send lists of materials needed to the Commanding General, Patterson Field, Ohio, Attention: Capt. John Bayless, Instructional Material Unit Disposal Branch.

AN easily-understood explanation of the electron and electronics is to be found in "A Primer of Electronics," a folder just published by General Electric Co., Schenectady, N. Y. Copies may be had free; ask for folder GED-1068.

DISPOSITION of equipment belonging to the now-defunct NYA has been covered in a recent Act of Congress. The equipment, as well as other NYA property, is to be transferred to the Director of Procurement of the Treasury Department.

Material not needed by the armed services is being made available to vocational schools and programs under the supervision of state directors of the vocational programs. Allocation of this equipment to individual schools is similar to that of National Defense Training equipment. NYA equipment may be loaned without compensation, or apparently sold to nonfederal vocational education authorities, according to some interpretations of the Congressional order.

The portion of this resolution pertaining to disposal of equipment, follows:

" . . . *Provided,* That all real and personal property of the National Youth Administration is hereby declared surplus, and all equipment, materials, and supplies shall be assembled, inventoried, and turned over to the Director of Procurement, Treasury Department, under Executive Order 9235 by the Administrator of the National Youth Administration as expeditiously as possible, and all real property shall be disposed of by the Commissioner of Public Buildings . . . ; *Provided further,* That, under commitment to return such property to the United States at borrower's expense, any real or personal property of the National Youth Administration in use on June 30, 1943, by any nonfederal vocational education authority within any state may continue to be so used during the period of the present war and for not to exceed six months after the termination thereof, without compensation, but in no event beyond the date such property ceases to be used for vocational purposes; *Provided further,* That during such period, the Director of Procurement, in the case of personal property, and the Commissioner of Public Buildings, in the case of real property, upon certificate of the United States Commissioner of Education that such property is to be used for vocational education and training, may loan, without compensation, to any such existing nonfederal vocational education authority, if applied for within 90 days after the date of enactment of this Act, any real or personal property of the National Youth Administration not required by any other Federal Agency (excepting the Lend-Lease Administration) or otherwise loaned under the authority of this paragraph, if such borrower agrees, in the case of personal property, to pay all expenses incident to obtaining and returning such property."

Sailplane Corporation Offers Aviation Program Plans

Aviation instructors are offered assistance through an instructional unit prepared by the joint efforts of Sailplane Corporation of America, Cornell University, and the New York State Education Department.

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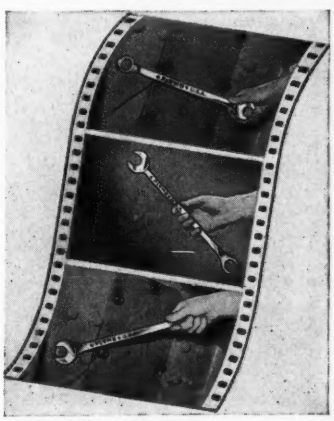

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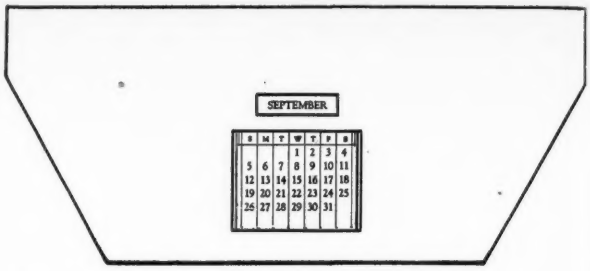
Perpetual Calendar Uses Many Printing Technics

BY *Philip A. Bortnick*



THE perpetual calendar recently developed in my printing classes has awakened a great deal of interest on the part of the students. An unusual number of printing technics is used in making this calendar, increasing its teaching value.

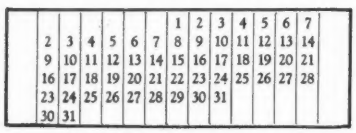
The technics employed cover: (1) use of butted rules; (2) breaking up a form for printing and scoring in separate operations; (3) scoring and cutting; and (4) press feeding.

The calendar consists of a four-ply base, on which two movable parts are mounted by means of slits cut with steel cutting rule. Stock for the base, or body, is of four-ply placard, in any attractive color. The slips carrying the names of the months and the dates are of a matching or contrasting color of durable tag or cover stock.

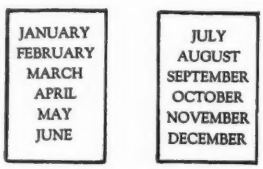
Figure 1 shows the four forms. Forms 2 and 3 back on one another, while form 4 must be done in two operations, printing and scoring and cutting. Sizes of each form are given in Figure 1.

Form 1, when printed, moves horizontally in the slits in the lower part of form 4, the base. The first of the month, then, can be moved to the proper day of the week for the month in question. Form 2 and 3 moves vertically in the slits at the top of form 4, to indicate the month. This form is turned over to show the months July to December.

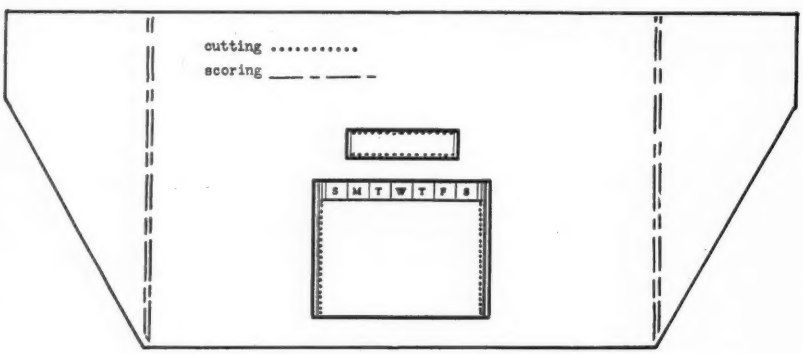
This calendar presents many challenges to the ingenuity of the student. The design of the base may be varied. The name of the school or department may appear on the face of the calendar in attractive type. And the production of the entire piece can be organized along industrial production lines.



Form 1 — 3 1/2" x 1 1/8"



Forms 2 & 3
15/16" x 1 1/2"
(3 backs up 2)



Form 4 — 8" x 3 3/4"
Two operations — printing and scoring

This useful project involves the use of many technics, yet is within the range of ability of the average junior or senior high school printing student. The author teaches printing at Roxbury Memorial High School, Boston, Mass.

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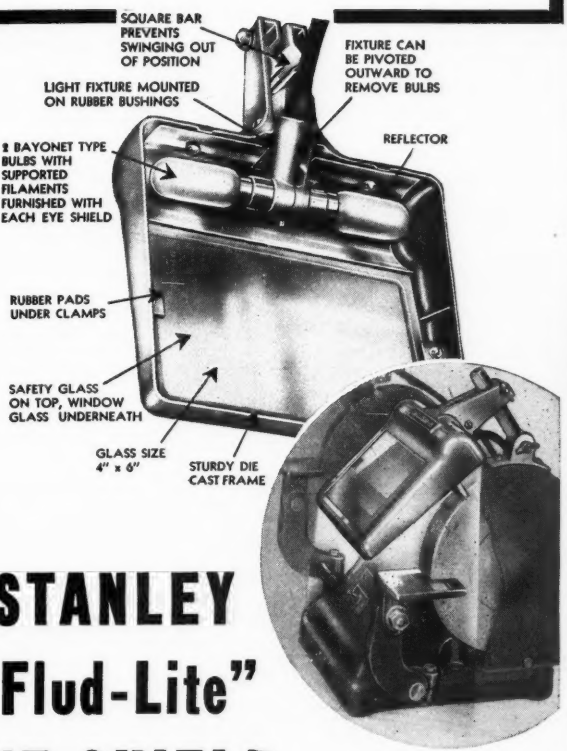
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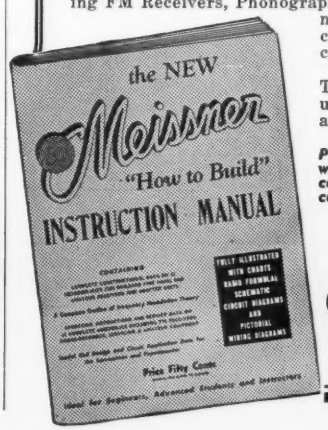
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Adjustable Clothes Prop

BY *Ward Sager*

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LAUNDRIES in many cities have been compelled to curtail service and Monday washday is again a feature of American home-life. The clothes prop shown in the drawing is a distinct advance over the two-nail stick of olden days and makes a piece of equipment that is fit to associate with the modern electric washer; one that may be stored in the basement or washroom when not in use rather than in or alongside the garage. It is an excellent project for woodworking or general shop students and is especially popular with mothers, grandmothers, aunts, and even the neighbors.

By substituting an ordinary thread spool for the turned spool and making the necessary correction in the depth of the notch, this project becomes suitable for beginning shop classes that usually do not include work with the wood lathe. In constructing the adjustable prop, opportunity is presented to use the fore or jointer plane, back saw, hand saw or jig saw, hand drill, screwdriver, files, etc., and also to solder a butt or lap joint on the metal bands that hold the two sections in place.

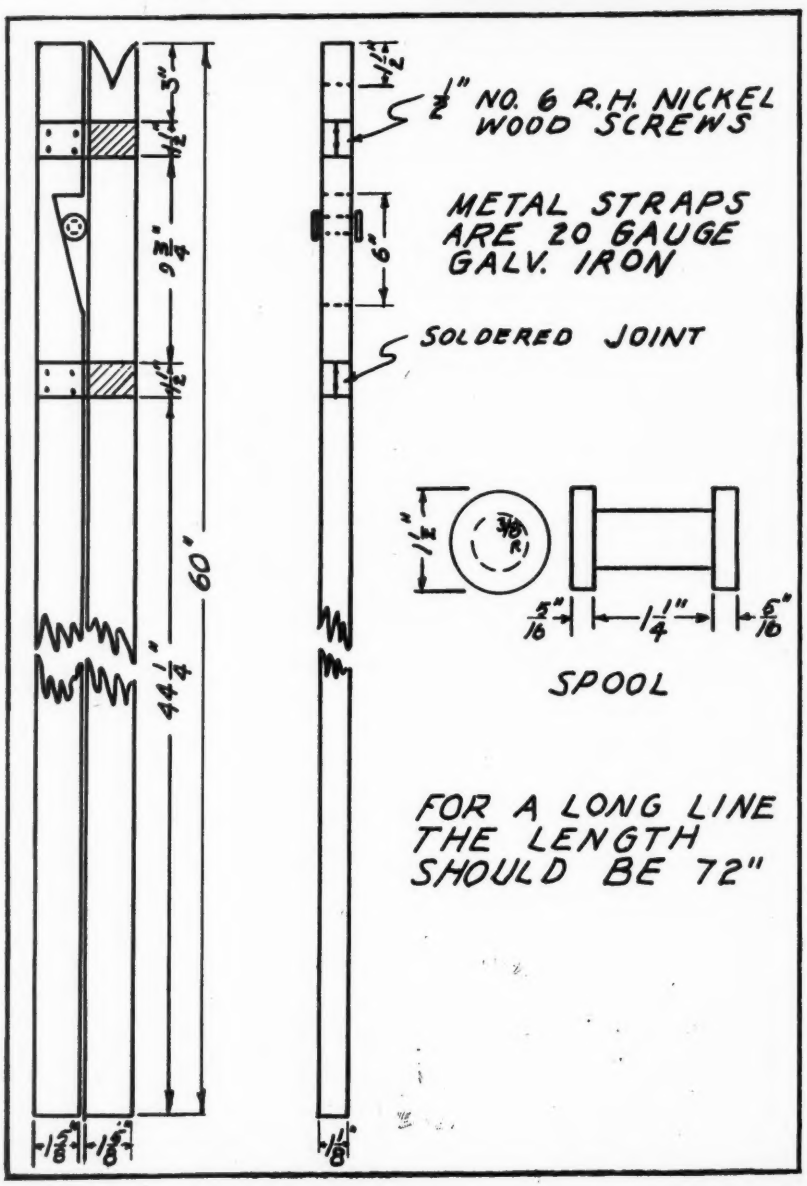
While the drawing is dimensioned for a prop of 5′ sections, it has been found that 6′ sections permitting extension to approximately 11′ are required for lines that exceed 40′ in length. Another change in specifications that might prove entirely satisfactory would be the use of standard 1″ lumber in place of 5/4″ material thus reducing the cost of the project.

We have used clear pine (B grade) of several species including Northern White, Western or Idaho White, and Ponderosa because of their ease of working with hand tools but hardwoods such as oak or birch could be used. One piece of 5/4″ x 6″ x 12′ material costing $1.35 may be sawed to produce stock for three props with 6′ sections, thus the material cost would be $.45 plus a few cents for metal and wood screws. Where lumber is purchased from a local yard it is certain to have a high moisture content and should be conditioned in the school shop for a couple of weeks before being sawed to dimension as otherwise it may warp so badly as to be unusable.

Construction of this project does not involve any specific problems. However, it may be noted that the metal bands should be bent to form a good fit. If they they are too tight the extension will not slide freely and if they are oversize the extension will tend to slip out.

With this, as with any project, a suitable finish enhances its value. A natural finish, wash coat of shellac and one coat of varnish, or two coats of clear lacquer may be applied. Some students have preferred a paint finish in which case outside white or grey paint is suitable.

This highly useful clothes prop is an excellent general shop project at the elementary level as it incorporates some sheetmetal work as well as hand-tool manipulation and simple turning. Ward Sager is a member of the faculty of Central Michigan College of Education, Mount Pleasant.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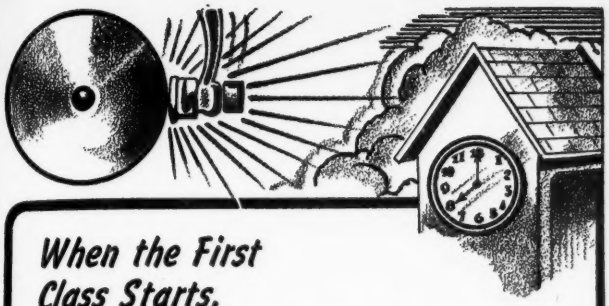
SPOOL
FOR A LONG LINE THE LENGTH SHOULD BE 72"
60"



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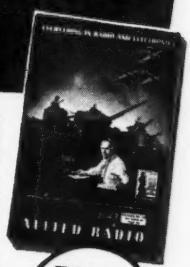

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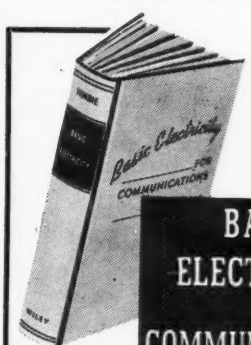

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Radio Troubleshooter's Handbook. Ghirardi. New York: Radio & Technical Publishing Co., 1943 (third Ed.). Pp. vii+744. $5.00.

This book lists case histories of common trouble symptoms and remedies for 4,820 models of standard home and auto radios and record changers. Sections also on alignment, cross-indexes of all types of radio sets, wiring diagrams, information on Army and Navy models, and other data for the radio man.

Alfred A. Ghirardi is technical consultant in radio, member of Institute of Radio Engineers, and author of many books on radio.

Understanding Radio. Watson, Welch, Eby. New York: McGraw-Hill Book Co., 1940. Pp. ix+603. $2.80.

A comprehensive, yet not too technical, treatment of radio. Chapters cover radio waves and wave travel; wave-form pictures; principles of the vacuum tube; and other components of all types of radio receivers and transmitters. Glossaries; index. Illustrated.

Herbert M. Watson is associate member of Institute of Radio Engineers. Herbert E. Welch is professor of radio technology and engineering, Stockton, Calif., Jr. College. George S. Eby is professor of applied science at the same school.

Electrical and Radio Dictionary. Dunlap, Hahn. Chicago: American Technical Society, 1943. Pp. 110. $1.00.

In addition to a complete dictionary of electrical and radio terms, this book also contains formulas, charts, and tables of use to electrical and radio workers and students. Charts of symbols are also included to aid in proper indication on architectural and mechanical drawings.

Carl H. Dunlap is chief engineer of the Electrical Division, the American School, Chicago and associate member of the A.I.E.E. Enno R. Hahn is editor of *Popular Mechanics* magazine and consulting engineer.

Treatise on Planers. Cincinnati: Cincinnati Planer Co., 1940. $1.00.

This book is a treatise on the operation of the metal planer, covering the various phases of planer work, such as tools, setting up the work, cutting speeds, specific types of planing work, and construction details of the metal planer. Illustrations, drawings, index.

Keep Your Lathe in Trim. South Bend: South Bend Lathe Works, 1943. Pp. 28. No charge.

This 28-page booklet is Bulletin H-4 in South Bend Lathe Works' series on how to get the most out of lathes. This book tells how to make necessary adjustments, check power supply, protect lathe from abuse, and keep it in best operating condition.

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Essential Mathematics for Skilled Workers. Keal, Leonard. New York: John Wiley & Sons, 1942. Pp. vii+293. $1.50.

This text serves as a brush-up manual for workers or students now needing the use of mathematics learned but since forgotten. It also serves to give a basic mathematical background for students in pre-induction and war industry training classes who haven't time to go into each phase of mathematics in detail. Covers arithmetic, geometry, algebra, trigonometry. Discussion is related to the actual uses to be made of the principles learned. Problems, appendix, index.

Harry M. Keal is head of the mathematics department of Cass Technical High School, Detroit, Mich. Clarence J. Leonard is head of the mathematics department of Southeastern High School, Detroit.

Spur Gearing. Owen. Bloomington: McKnight & McKnight, 1943. Pp. 63. $0.72.

This book is an attempt to remove some of the mystery from the subject of gearing and to present it simply and briefly for the shop student. Chapters deal with friction wheels and development, cycloidal and involute gearing, tooth nomenclature, proportions of gear teeth, backlash, checking, standard gear systems, and problems in gear calculating. Illustrations, drawings.

W. M. Owen is training supervisor of Caterpillar Tractor Co., Peoria, Ill.

Useful Shop Tables and Information. Scranton: International Textbook Co., 1943 (new edition). Pp. 124.

This small, pocket-size book is a handy compilation of tables, formulas, rules, and data needed by shop men in all types of shop work. Mathematical tables are also included. Index.

Practical Radio for War Training. Beitman. Chicago: Supreme Publications, 1943. Pp. 336. $2.95.

A radio text designed primarily for the many types of wartime radio courses. Covers the radio receiver, mechanics and methematics of radio, resistor circuits, coils, condensers, tubes, meters, and other radio components. Review questions and problems. Illustrated. Index.

M. N. Beitman teaches in the Chicago schools, is a member of the Institute of Radio Engineers, and author of radio books and articles. He was formerly an engineer with the U.S. Signal Corps.

Principles of Centerless Grinding. Cincinnati: Cincinnati Grinders, Inc., 1942. Pp. 48. No charge.

An illustrated booklet describing the principles of centerless grinding. Details of the centerless grinder are discussed and illustrated, as well as various specific ways in which they are used.

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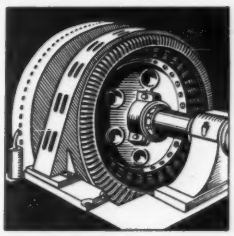

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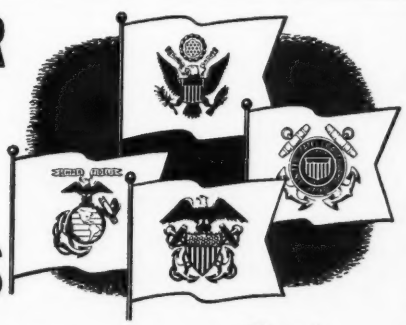

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Setting Up an Automotive PIT Class

BY *G. H. Billingham*

Here is a plan of class procedure which will be helpful to schools establishing a pre-induction course in automotive mechanics. Schools inaugurating auto-mechanics work also will be interested in the same author's article on page 6 of the April, 1943, issue of SCHOOL SHOP. He is Supervisor of Industrial Arts, Weehawken, N.J.

THE number of students in an auto-mechanics class should be determined by the facilities available (engines, extra units, etc.) and the floor space. However, other factors often control the enrolment, so the instructor must plan accordingly. Dividing the class into squads of four, one being selected as leader, makes workable units, and gives a touch of armed service methods. In addition, one student should be assigned as tool keeper, and another to see that the shop is straightened up as, or soon after, the class leaves. The squad leaders can help a great deal by seeing that tools, equipment, reference material, etc., used by their group are cleaned and replaced.

The modern industrial shop is clean, so the school shop should emphasize this practice. A material can be purchased to throw on oil spots to absorb them, and if students furnish their own coveralls they should be encouraged to have them washed frequently. Each student should have a piece of cotton waste or clean cloth in his pocket to use for wiping his hands, parts, etc. Cans should be provided at convenient places to throw oily rags. A five-gallon can with part of the top (leaving handle) and some of the sides and front cut away makes an inexpensive container. Empty daily into a covered container.

Students should be encouraged to bring in small parts, and give a talk on them. Perhaps they helped to replace them in the family car. Nearly every private garage has one or more parts laying around. (Junk yards will furnish broken parts for classes of this sort.) These tell a story of the average citizen's car problems and whether they were solved or not.

Auto manufacturers (pre-war) still have material that can be secured free or for a nominal amount. Parts and accessories companies are more than willing to aid this part of our war program. Wall charts and other teaching aids help to build up and maintain student interest.

If you have a library available have a student get a list of the auto-mechanics books on the shelves, and post it on the bulletin board.

Suggested First Lesson

General Inspection.—Brief explanation of units, parts, and text material. Ask students to furnish their own clothing cover, or appoint a committee to see about purchasing uniform equipment. An arrangement of some sort might be made with a laundry to provide the apparel at nominal cost. Keep a cloth in the pocket. Explain about the use of some sort of protective cream on the hands. Show a sample and demonstrate its usefulness. Encourage the use of gloves where necessary.

Stress First Aid.—Show location of first-aid cabinet or supplies, and specify who is to apply the first aid. Request that students take care of instructional material. Ask each student to provide a notebook, as the War Department in its booklet PIT202, *Fundamentals of Automotive Mechanics*, page 12, paragraph 8, states that the instructor should insist on having each pupil develop a satisfactory notebook for the course. A sticker in the upper corner of the cover makes a uniform place for the student's name and squad number. Cover this with scotch tape to avoid soiling. Be sure to reserve a few pages for an index.

The class should be advised that there is to be no unorganized dismantling, or "tearing down" (shop term), of equipment. Arrange time for finishing a job, under routine conditions, before it is started.

Lt. Dobbins and three enlisted men in Iceland putting to good use their knowledge of automotive mechanics. (Photo by U.S. Army Signal Corps.)

Class Personnel

Tool Keeper.—Schedule preferably listed on a chart.

Duties: To distribute and check the return of equipment, tools, parts, instructional material, etc. See that returned articles are *clean*, and in good condition. Note unusual conditions on slip. (May be printed or typed of uniform size, with date and form to meet shop conditions.) Turn in slip before leaving. Keep slips on file.

Maintenance Foreman and Assistant Foreman.—(Replaces M. F. when he is off duty.)

Duties: (1) Check major units. (2) Check benches, etc. (3) Check washroom. (4) Report before leaving.

Squad Leader.—Schedule preferably listed on a chart.

Duties: (1) Help keep the squad together. (2) See that assignment is taken care of, to best of their ability. (3) Check equipment used and see that everything is replaced. Can do a lot toward keeping harmony in the unit.

Suggested Assignments for Future Lessons

Squad I.—Examine a partly dismantled unit and list parts needed to make it run. Furnish an owner's manual (furnished by the maker) as reference material. This is research students like.

Squad II.—Check a discarded clutch (can be obtained at a service station or junk yard). Find out whether it is standard, multiple-disc, etc. What, if anything, is wrong with it? Car manual as reference material.

Squad III.—Furnish with downdraft and updraft carburetors. Have them examine the features, and report on the differences. Service books for reference material.

Squad IV.—Clutch can be examined in a unit. Check the type, adjustments (if any), and approximate condition.

Squad V.—Typical valve arrangements. Check the engines available and make report on types. Furnish reference material.

Note: See that each squad covers each assignment.

Other topics which will maintain interest are:

Oil cleaners.	Types of chassis.
Air cleaners.	Shock absorbers.
Rear ends.	Water pumps.
Transmissions.	Oil pumps.

Taper Turning . . .

(Continued from page 13)

until the tool post almost touches the footstock spindle. If the feeler gage makes the same clearance in the same spot as it did before, the tailstock is set over accurately to .181.

Method B. Using a sample piece:

On a machine not equipped with a micrometer collar on the cross feed it is possible to cut an accurate taper by using a sample piece. Usually a piece long enough to give 12″ of free turning with the dog in place will give the best results. Suppose we have to cut a No. 3 Morse taper which is .602″ per foot. We mark off on the piece exactly 12″ and take a light cut at a point which will enable us to take a micrometer reading exactly 12″ from the end of the piece. Suppose the reading is .964. Now without changing the setting on the micrometer collar on the cross feed, turn back the tailstock sufficiently to remove the work. Run the carriage back to the tailstock center, using the hand wheel. Set the tailstock over approximately .300. Put the work between the centers and take a light cut. When the micrometer reading is .362, the lathe is set to cut an accurate No. 3 Morse taper.

Method C. Using a dial indicator:

The dial indicator provides a very accurate method of cutting a taper within its range. Suppose a piece of stock is to be turned to a taper 1.000″ in diameter at one end and .900″ at the other end. First set the piece between centers and indicate it so that it is accurately centered. Then with the indicator at the tailstock end of the piece offset the tailstock until the dial registers .050. This setting will cut the desired taper.

Methods of Checking Tapers

The use of calipers and steel scale is a very rough check. Nothing more than an approximate taper can be gaged in this way. A template is frequently used to check tapers on centers, screw heads, etc. The micrometer may be used as per the suggestions made under Method B for turning tapers. This is a fairly accurate method. The use of a sine bar is accurate. Here the taper is built up from a flat surface until a dial indicator will read 0 as it is run along the entire length of the taper. From the reading on the sine bar it is possible to determine the taper. The indicator will locate high spots and low spots. But the best method, because it is precise, is the use of a taper gage.

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from WASHINGTON by MICHAEL PACA

Secretary of War Appeals Two Programs for "Rehab"

EVEN as hundreds of thousands of young men in new uniforms are "going off to the wars," thousands of others are already streaming back from the battlefield, discharged by reasons of injury or age. For these two groups, as well as for a third large group —the maimed and the injured from the home and war production fronts—Washington set in motion vocational training or retraining plans.

● *On behalf of men and women about to see active service,* Secretary of War Stimson appealed directly to vocational and industrial arts educators to give them "basic knowledge and technical skills needed for modern combat."

He was joined in the plea by General Brehon Somervell, of the Army Service Forces, who said that schools must help the Army pretrain its specialists regardless of cost, time, inconvenience and even if it means "temporary scrapping of peacetime courses."

These are strong words. But they come from men who have just toured the battlefields and front lines; and who know that the roads to Berlin and Tokyo are still long and arduous. They know, too, that trained specialists will be the first on that road, leading our troops to the Axis capitals. These specialists can be conditioned by the Army more swiftly if the schools help with preinduction training.

The War Department, therefore, is asking vocational and industrial arts authorities to search their souls again with this question: "Are we doing all the preinduction training for the Army that we can?"

The Army is aware of all the problems that stand in the way of teachers and principals eager to cooperate. For example, no Federal funds are available for preinduction training; yet in many communities authorities are obtaining some help from the Smith-Hughes and George-Deen programs as well as from the Rural War Production and the Vocational Training for War Production programs. Under certain conditions, the first two programs may be used as a source for money with which to reimburse preinduction instructors; and the latter two programs may provide space and equipment when not used on a full-time schedule.

"Adjust, improvise, work out problems of space and equipment somehow," says the War Department. "Use the same type of ingenuity we would expect our men to use if they were stranded on the desert with a battered tank or lost in the Strait of Messina on a raft."

Some help is available from the U. S. Office of Education and the War Department for educators ready to expand or introduce preinduction training. A bulletin on the subject, entitled *Preinduction Training in Vocational Schools, Vocational Departments and Trade Schools* (PIT 330) is now ready with many practical aids. Supplementary materials, each dealing with an occupational area vital to the Army, are also under way.* Nor will these bulletins deal with jobs done only by men. Bulletins for WACS, describing jobs women will be doing in Tunisia, Sicily and eventually liberated Germany, are also being planned.

● *On behalf of veterans returning from the fronts,* Congress passed a new vocational rehabilitation law, to be administered by the Veterans Administration.

General Hines, Administrator of Veteran's Affairs, has appointed 52 vocational rehabilitation directors, covering the entire country. These men are now assembling their "soldier rehabilitation staffs," for counselling, guidance, training, and placement services. The VA may make contracts with any public or private vocational training institution to fit the ex-soldiers for a job.

● *On behalf of those injured in industry, merchant shipping, and in civilian protective services* (air-raid wardens or aircraft spotters, for example), Congress passed the Barden-LaFollette Bill.

This bill "extends and improves" the Act of June 2, 1920, which had been administered for 20-odd years, first, by the Federal Board for Vocational Education and later by the U.S. Office of Education.

However, the Barden-LaFolette Bill has two provisions which are causing considerable talk in Washington. First, the bill places responsibility for the program not in the hands of the U.S. Commissioner of Education but in the hands of the Federal Security Administrator (Paul V. McNutt). Second, the bill removes the ceiling of $3,500,000 which the old Act had set; placing no limit on the funds which the federal government can contribute. The dollar-for-dollar matching provision is retained.

The talk in Washington is that Mr. McNutt will pull out the Vocational Rehabilitation Division from the Office of Education and will set up an independent bureau responsible to himself; and second, that the federal government may pour into the states as high as $25,000,000 a year for vocational rehabilitation. Officially, however, the old set-up is still in business—but look for important changes within 30 days.

NYA Property in Demand How to Get a Million Dollars

● *Now that the National Youth Administration is dead,* the big question is who will inherit its equipment and property? The Committee which killed the NYA was specific on that point. It said: First choice goes to those nonfederal vocational education authorities who were using the equipment on June 30, 1943.

Next choice: To federal agencies, primarily War and Navy Department and the Maritime Commission.

Next choice: other nonfederal vocational authorities, who apply to the U.S. Commissioner of Education before the end of October.

Do industrial arts departments have any chance to obtain any NYA tools and equipment?

There is no reason why not, says the Office of Education, providing the three high-priority claimants have been served first. These claimants are already bombarding not only the Commissioner of Education but also their Senators and Congressmen with applications for the much-needed equipment.

● *Here's a tip on how to get a million dollars* from public authorities for education. When Washington officials came before a Congressional committee to ask for funds to continue the visual aids for war training program they brought with them the usual kit of facts and literature to justify the project. They told Congressmen that in 1943-1944 the Office of Education plans to produce 144 new motion pictures on machine-shop and ship-building operations, and to add as an innovation a film strip and teacher's manual for each motion picture.

But Washington officials might not have gotten far with this request using words alone. Instead, they treated Congressmen to a free show of one of the films produced under the program last year. Result (whether direct or indirect): Congress increased by $1,000,000 the funds granted this program during 1942-1943. Oh, the power of pictures!

**At the printer's now are: bulletins on aircraft mechanics, automobile mechanics, communications (including radio, telephone, and telegraph), and machine-shop practice.*

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New Priority Data . . .

WPB regulation CMP-5A has been amended giving schools the somewhat higher rating of AA-2. Otherwise the regulation is substantially the same.

WPB form PD-408 used by some schools, has been replaced by form WPB-837. A number of changes have been made in the procedure for filling out this form. Detailed information will appear in the October SCHOOL SHOP.

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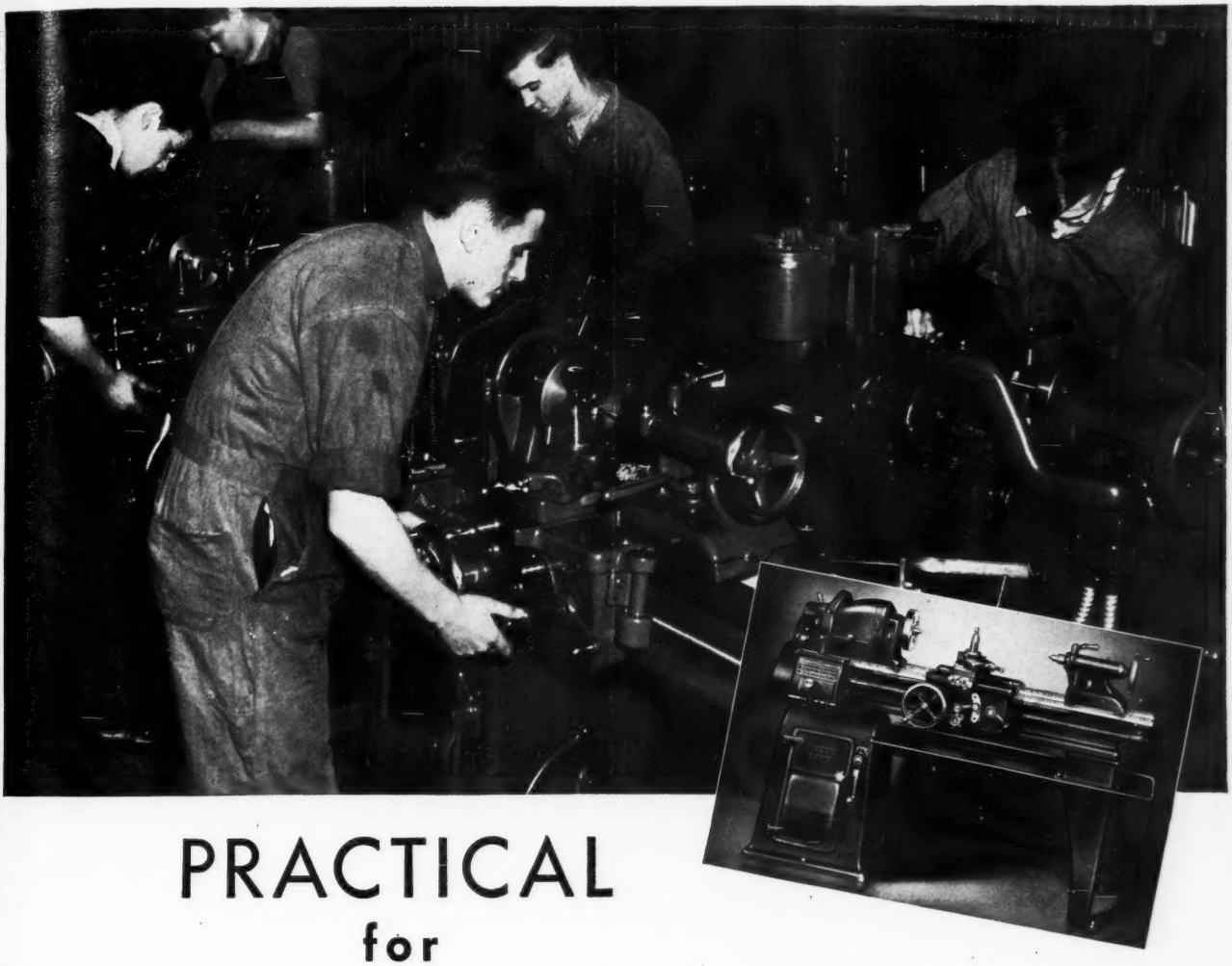

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